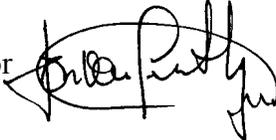


COMMONWEALTH OF VIRGINIA
Department of Environmental Quality
Division of Water Quality

Subject: Guidance Memo No. 04-2017
Nutrient Monitoring and Maximum Annual Loads for VPDES Permitted Facilities on the DEQ Chesapeake Bay Program's List of Significant Discharges.

To: Regional Directors

From: Jon van Soestbergen, P.E., Director
Office of Water Permit Programs 

Date: July 15, 2004

Copies: Rick Weeks, Regional Water Permit Managers, CBP staff, OWPP staff

Summary:

This guidance provides direction to VPDES permitting staff related to an agency decision to henceforth include nutrient monitoring and maximum annual loads for total nitrogen and total phosphorus in VPDES permits for facilities that are listed on the DEQ Chesapeake Bay Program's (CBP) Significant Discharger List (SDL). Effective as of the date of this guidance, upon permit reissuance, VPDES permits for CBP SDL discharges are to include total nitrogen and total phosphorus monitoring requirements and special condition; annual total nitrogen and total phosphorus effluent limitations, where applicable; requirements for submittal of a Basis of Design Report and an Interim Optimization Plan; and a reopener clause as specified in this guidance.

Electronic Copy:

An electronic copy of this guidance in PDF format is available for staff internally on DEQNET, and for the general public on DEQ's website at <http://www.deq.virginia.gov/water>.

Contact Information:

Please contact Allan Brockenbrough, Office of Water Permit Programs, at (804) 698-4147 or abrockenbrough@deq.virginia.gov with any questions regarding the application of this guidance.

Disclaimer:

This document is provided as guidance and, as such, sets forth standard operating procedures for the agency. However, it does not mandate any particular method nor does it prohibit any particular method for the analysis of data, establishment of a wasteload allocation, or establishment of a permit limit. If alternative proposals are made, such proposals should be reviewed and accepted or denied based on their technical adequacy and compliance with appropriate laws and regulations.

**Nutrient Monitoring and Maximum Annual Load Limitations
for VPDES Permitted Facilities on the
DEQ Chesapeake Bay Program's Significant Discharger List**

Background and Purpose

Significant portions of the Chesapeake Bay and its tributaries are listed as impaired on Virginia's 303(d) list of impaired waters for not meeting the aquatic life use support goal, and the draft 2004 Virginia Water Quality Assessment 305(b)/303(d) Integrated Report indicates that 83% of the mainstem Bay does not fully support this use support goal under Virginia's water quality assessment guidelines. Nutrient enrichment is cited as one of the primary causes for impairment. Virginia is committed to protect and restore the Chesapeake Bay and its tributaries from the harmful effects of nutrient enrichment, and through participation in the Chesapeake Bay Program and implementation of special state initiatives, Virginia maintains a firm commitment to rehabilitate its estuarine resources. In addition to the voluntary nutrient reduction efforts that have been ongoing for over 20 years, several regulatory initiatives are now underway to achieve the river basin nutrient load allocations agreed to by the Chesapeake Bay Program partners in April of 2003. Virginia's current regulatory initiatives include development of nutrient water quality standards for the Bay and its tributaries, development of a regulation to govern the inclusion of technology-based, numerical nitrogen and phosphorus limits in VPDES permits, and a parallel effort to update and amend the Water Quality Management Planning regulation 9 VAC 25-720.

The DEQ Chesapeake Bay Program (CBP) maintains a list of significant discharges of nutrients to the Chesapeake Bay and its tributaries. Nitrogen and phosphorus loads from these discharges are determined from discharge monitoring or are estimated using default values where no data exists. These data and estimates support computer modeling efforts used to evaluate current impacts, to predict future nutrient impacts, and to assist in establishing nutrient reduction goals set forth in the Chesapeake Bay Tributary Strategies. Such data has traditionally been collected through requirements in VPDES permits, grant funding agreements, and voluntary monitoring. These efforts have resulted in the collection of a significant amount of data for many of the facilities on the CBP Significant Discharger List (SDL). However, for many others there are still data gaps that could be filled, and there exists a lack of consistency in the data and frequency with which it is collected.

To assist in establishing consistent data to support regulatory actions currently underway and to provide definitive load estimates for nutrients from affected VPDES permitted discharges, DEQ is committed to increasing the confidence level in the current nutrient loads attributed to CBP SDL discharges. To address these data issues, DEQ has made a decision to include, henceforth, minimum nutrient data collection and frequency requirements in VPDES permits for facilities listed on the CBP SDL.

To minimize additional nutrient loading to the Chesapeake Bay and its tributaries from CBP SDL discharges, where applicable, individual allocations based on nutrient loads over a three year period will be included as effluent limitations in the VPDES permits for CBP SDL facilities. These effluent limitations will remain in effect until such time as water quality standards are promulgated or nutrient load allocations are established through DEQ's current regulatory

initiatives. Because insufficient data exists to establish individual loads for all CBP SDL facilities, individual allocations will be set when sufficient data becomes available.

To prepare for the outcome of current regulatory initiatives and the anticipated treatment upgrade requirements resulting from promulgation of water quality standards to address the effects of excessive nutrients discharged to the Chesapeake Bay, each facility listed on the CBP SDL will be required to prepare and submit a Basis of Design Report to address construction and operation of a range of nutrient removal technologies, up to and including the limit of technology. Submittal of the Basis of Design Report should be included as a VPDES permit requirement. Additionally, alternatives and interim measures that may be taken to optimize nutrient removal with the existing facilities should be evaluated, and a report should be submitted that summarizes the alternatives considered and provides a plan to implement a selected interim measure.

The following sections identify the affected discharges, establish nutrient monitoring requirements to be included in VPDES permits for these discharges, specify permit language, and provide the basis and methodology to be used to establish CBP SDL loads for each individual CBP SDL facility.

Affected Permitted Discharges

Affected permitted discharges are VPDES permitted discharges listed on the CBP SDL. The list is dynamic and changes over time. Updates to the list are maintained by CBP staff and communicated by CBP staff to the Director, Office of Water Permit Programs and to the Regional Water Permit Managers. The most current list is available to the public at the following url:

<http://www.deq.state.va.us/bay/VASignificantListbyVPDES.pdf>

Nutrient Monitoring Requirements

Permits for facilities that are on the CBP SDL should, upon permit reissuance, contain a minimum level of nutrient monitoring as follows:

Parameters:

- Total Phosphorus
- Orthophosphate
- Total Nitrogen
 - Total Kjeldahl Nitrogen (as N)
 - Nitrate plus Nitrite (as N)
 - Total Nitrogen (to be derived as the sum of TKN and Nitrate plus Nitrite)

Sampling Type and Collection Frequency:

- Sample type should be consistent with the sampling requirement for BOD in the VPDES permit.
- Collection frequency should be a minimum of twice a month (2/M), a minimum of two weeks apart, for facilities with minor industrial or minor municipal permits, and weekly (1/W) for facilities with major industrial or major municipal permits.

A sample Part I.A is attached for use in VPDES permit development.

Basis of Design Report and Interim Optimization Plan

VPDES permits for all facilities on the CBP SDL should include a special condition requiring the submittal of a Basis of Design Report within one year of the permit effective date. The report should include an analysis of alternatives that would allow the permittee to maintain or reduce nutrient concentrations to the following **annual averages** identified in the November 2002 report entitled *Nutrient Reduction Technology Cost Estimations for Point Sources in the Chesapeake Bay Watershed*:

Point Source Category	Tier 1	Tier 2	Tier 3	Tier 4
Significant Municipals	TN=8.0 mg/l for those with BNR operating or planned; TN and TP for rest of facilities = 2000 concentration	TN = 8.0 mg/l TP = 1.0 mg/l or permit limit if less	TN = 5.0 mg/l TP = 0.5 mg/l or permit limit if less	TN = 3.0 mg/l TP = 0.1 mg/l
Significant Industrials	TN and TP = 2000 concentrations or permit limit if less	Generally a 50% reduction from Tier 1 (or 2000 concentrations) or permit limits if less	Generally an 80% reduction from Tier 1 (or 2000 concentrations) or permit limit if less	TN = 3.0 mg/l TP = 0.1 mg/l or permit conditions if less

The Basis of Design Report should evaluate various treatment alternatives available to meet a range of treatment alternatives from the minimum level of nutrient removal considered by a facility up to and including Tier 4 (considered the Limit of Technology in the November 2002 report). At a minimum, the report should include

- a. wastewater characterization
- b. evaluation of the existing treatment facility
- c. description and process flow diagrams of each alternative
- d. basis of design for cost estimates
- e. estimates of project's cost (total)(dated, keyed to construction cost index, escalated, etc.)
- f. advantages and disadvantages of each alternative
- g. individual differences, requirements, limitations
- h. selection of preferred alternative for each treatment tier
- i. justify selection and present tabulated comparisons
- j. characteristics of treatment process performance

- k. operation and maintenance expenses
- l. annual expense requirements (tabulation of annual operation, maintenance, personnel, debt obligation)

Due to differences in various waste characteristics and/or other unique process constraints (e.g. high levels of refractory organic nitrogen in some industrial wastestreams), every permittee may not be able to obtain the effluent concentrations identified in the table above. In such cases, the Basis of Design Report should identify the annual average effluent concentrations that could be obtained given the commensurate level of treatment. Although treatment tiers are defined above in terms of effluent concentrations, reductions in nutrient loads are the real goal for the CBP. Pollution prevention measures that provide an equivalent reduction in nutrient loads should be encouraged.

Additionally, a separate plan to address alternatives to optimize nutrient removal with the existing facility should be required within one year of the permit effective date. DEQ is committed to providing assistance in the development of an interim optimization plan and the Basis of Design Report. Therefore, as time and resources allow, the Water Quality Division's Office of Operator Training will assist permittees who have contacted that office in establishing and adhering to the required written plan to optimize nutrient removal with the existing facility. Additionally, grant funding to offset a portion of the costs to develop the Basis of Design Report may be provided at the discretion of the DEQ Director in accordance with the provisions of the Virginia Water Quality Improvement Act (WQIA) and its accompanying guidelines. Compliance with the requirement to submit a Basis of Design Report in accordance with the permit condition is not contingent upon receipt of a Technical Assistance grant under the WQIA. In addition, receipt of grant funding for this purpose does not obligate the Commonwealth to provide additional grant funding for design and construction of any nutrient removal facilities.

Maximum Annual Nutrient Load Allocations

During the VPDES permit reissuance process for facilities listed on the CBP SDL, regional office staff should evaluate the availability of nutrient data for the process wastewater outfalls at the facility for the most recently available three-year period. A minimum of 12 data points are required. If available, this data is to be used to establish the total nitrogen and total phosphorus load contributed through each process wastewater outfall by the facility over the three-year period evaluated. Storm water and non-process wastewater (i.e. non-contact cooling water, etc.) outfalls should be excluded from the evaluation.

Where sufficient effluent monitoring data exists, an annual maximum total nitrogen load and an annual maximum total phosphorus load should be included in the reissued VPDES permit as effluent limitations. Except as specified below, use the following procedure to determine the maximum annual limits:

- (1) Determine the 80th percentile of the monthly total nitrogen and phosphorus loads based on previously reported monthly average loads or monthly average concentrations and monthly average flows for the most recent three-year period for which data are available. The minimum number of data points should be 12. (Note:

80th percentiles are calculated using the "rank and count" method employed by the "percentile" function of most spreadsheets.)

- (2) Use the results from (1) in the following formula:

$$AL = ML_{80} \times 12$$

where:

$$\begin{aligned} AL &= \text{Annual total nitrogen or total phosphorus load (kg)} \\ ML_{80} &= \text{80}^{\text{th}} \text{ percentile of monthly total nitrogen or phosphorus loads (kg)} \end{aligned}$$

For facilities with water quality improvement fund (WQIF) grant funding for biological nutrient removal to achieve a specified total nitrogen or total phosphorus concentration, use the following calculation to determine the annual maximum limit for total nitrogen or total phosphorus:

$$AL = Q_{\text{avg}} \times C \times 3.785 \times 365$$

where:

$$\begin{aligned} AL &= \text{Annual maximum total nitrogen load (kg)} \\ Q_{\text{avg}} &= \text{Average annual flow for the most recent three-year period, not to exceed VPDES permitted flow (MGD)} \\ C &= \text{WQIF agreement specified total nitrogen or total phosphorus concentration (mg/l)} \end{aligned}$$

Facilities subject to the Policy for the Potomac Embayments, the Occoquan watershed policy, or the Chickahominy watershed standards are exempt from the above requirements for phosphorus.

The Office of Water Permit Programs (OWPP) has data compiled by the Office of Water Quality's Chesapeake Bay Program for CBP SDL facilities. This data and assistance in establishing the annual maximum loads can be obtained by contacting OWPP.

Note that it is important that the effluent data evaluated in accordance with the above procedures be representative of the current discharge. For example, if a facility has upgraded within the past three years, it would be appropriate to exclude any data collected prior to the upgrade from the evaluation. Likewise, there may be various other situations (e.g. diversion of significant flows from one POTW to another to facilitate construction at the first POTW, CSO facilities, industrial shutdowns, etc.) where the procedures outlined above do not result in limits which reflect what can reasonably be obtained at a facility. In such cases a site specific loading limit should be developed which reflects the goal of this guidance of maximizing nutrient removal within the limitations of existing facilities.

Implementation of Annual Nutrient Load Allocations in VPDES Permits

At the time of permit reissuance, each VPDES discharge permit for CBP SDL facilities should contain monitoring requirements as provided in this guidance, and where applicable a special condition identifying the individual effluent limitations as follows:

- 1) Facilities with an annual load established based on actual nutrient data or based on a WQIF agreement concentration – The VPDES permit for these facilities should contain annual maximum effluent limitations for total nitrogen and total phosphorus established as outlined above.
- 2) Facilities for which flow and/or nutrient load data is not available – The VPDES permit for these facilities should initially not contain individual effluent limitations for total nitrogen and total phosphorus. The VPDES permit should be reopened to include annual maximum effluent limitations after an annual average load is established based on three years' effluent monitoring data for total nitrogen and total phosphorus collected as required by the VPDES permit.

A sample Part I.A is attached for use in VPDES permit development.

Reopener Clause

Upon reissuance, VPDES permits for facilities listed on the CBP SDL should contain the following reopener clause:

***Nutrient Enriched Waters Reopener** – This permit may be modified or, alternatively, revoked and reissued to incorporate new or alternative nutrient limitations and/or monitoring requirements should the State Water Control Board adopt nutrient standards for the waterbody receiving the discharge, including the Chesapeake Bay or its tributaries, or if a future water quality regulation or statute requires new or alternative nutrient control.*

[If the permit does not contain annual load limitations for total nitrogen or total phosphorus, also include the following special condition:] This permit may be modified or, alternatively, revoked and reissued to incorporate annual maximum total nitrogen and total phosphorus effluent limitations based on three years of monitoring data collected as required by this permit.

Special Conditions

Permits that require nutrient monitoring and/or annual maximum effluent limitations for total nitrogen and total phosphorus should contain the following special condition.

Nutrient Reporting Calculations

For each calendar month, the DMR shall show the total monthly load (kg) and the cumulative load for the calendar year, to date (kg) calculated in accordance with the

following formulae.

$$ML = ML_{avg} * d$$

where:

ML = total monthly load in kg

ML_{avg} = monthly average load as reported on DMR (kg/d)

d = number of discharge days in the calendar month

$$AL-YTD = \sum_{Jan-current\ month} ML$$

where:

$AL-YTD$ = calendar year-to-date annual load in kg

The total nitrogen load and total phosphorus load for each calendar year (AL) shall be shown on the December DMR due January 10th of the following year.

All reissued permits on the CBP SDL should contain the following special conditions requiring submittal of a Basis of Design Report and an Interim Optimization Plan.

Basis of Design Report for Nutrient Removal

Within one year of the effective date of this permit, a Basis of Design Report addressing the construction and operation of a range of nutrient removal technologies up to and including the limit of technology, shall be submitted to the Department of Environmental Quality. Additional information on the scope and contents of a Basis of Design Report is available from DEQ staff.

Interim Optimization Plan for Nutrient Removal

Within one year of the effective date of this permit, a report addressing alternatives and interim measures that may be taken to optimize nutrient removal with the existing facilities shall be submitted to the Department of Environmental Quality. The report shall describe alternatives considered and a plan to implement the selected interim measures.

Fact Sheet Language

The following suggested Fact Sheet language is provided for use by permit writers to provide justification for the required nutrient monitoring, submittal of the Basis of Design Report and Interim Optimization Plan, and for total nitrogen and total phosphorus limitations in VPDES permits for affected permitted discharges:

Significant portions of the Chesapeake Bay and its tributaries are listed as impaired on Virginia's 303(d) list of impaired waters for not meeting the aquatic life use support goal, and the draft 2004 Virginia Water Quality Assessment 305(b)/303(d) Integrated Report indicates that 83% of the mainstem Bay does not fully support this use support goal under Virginia's water quality assessment guidelines. Nutrient enrichment is cited as one of the primary causes for impairment.

Guidance Memorandum 04-2017 implements DEQ's best professional judgment decision to limit increases in nutrient loading from facilities listed on the Chesapeake Bay Program Significant Discharger List. Guidance Memorandum 04-2017 provides the basis for this decision and specifies the procedure for determining annual effluent limitations for these parameters for each affected facility, as well as monitoring requirements and a special condition to be included in each affected permit. Additionally, Guidance Memorandum 04-2017 includes a special condition for submittal of a Basis of Design Report to construct and operate a range of nutrient removal technologies, including but not limited to the limit of technology, as well as a special condition requiring consideration of alternatives and submittal of a plan to optimize nutrient removal with the existing facility. In accordance with the guidance memorandum, this permit contains a special condition requiring submittal of these reports.

Information Clearinghouse and Operator Assistance

It is the permittee's responsibility to track and report nutrient load status toward the annual load limit. As part of development of the plan to minimize the discharge of nutrients required by the special condition in the VPDES permit, it is recommended that the permittee contact the Water Quality Division's Office of Operator Training. As resources and time allow, the Office of Operator Training will assist permittees who have contacted that office in establishing and adhering to the required written plan of action to minimize the further discharge of nutrients.

The Offices of Operator Training, Water Quality Program's CBP and Water Permit Programs will collaborate to explore the feasibility of and establish, if possible, an information clearinghouse for the purpose of promoting and assisting permittees in maximizing the nutrient removal efficiency of their existing facilities through operational control and/or other means. The Office of Operator Training will, if and as resources allow, lead the technical aspects of this initiative and the Chesapeake Bay Program will lead the procedural aspects. DEQ's water permitting program will encourage, through contact by regional office permit writers, permitted facilities in the Chesapeake Bay drainage area to participate in the effort and take advantage of the information available through the clearinghouse.

Communication

Regional office staff should inform affected permittees of their status as a significant discharger, the initiatives of this guidance and the implications thereof, and should encourage consideration by the permittees to adopt proactive measures to reduce the discharge of nutrients from the affected permitted discharge.

Compliance

Compliance will be evaluated at the end of each calendar year. Facilities that did not exceed the annual effluent limitation in their VPDES permit will be considered in compliance, whereas those that exceeded the annual effluent limitation will be deemed out of compliance.

Such discharges shall be limited and monitored by the permittee as specified below:

LIMITS NOTED ARE EXAMPLES

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS						MONITORING REQUIREMENTS	
	MONTHLY AVERAGE		WEEKLY AVERAGE		MINIMUM	MAXIMUM	FREQUENCY	SAMPLE TYPE
	mg/l*	kg/day*	mg/l*	kg/d*	mg/l*	mg/l*		
Flow (MGD) [a]	NL		NA		NA	NL	Continuous	TIR
BOD5	20	38	30	57	NA	NA	3 Days/Week	8-HC
Total Suspended Solids	30	57	45	85	NA	NA	3 Days/Week	8-HC
Ammonia	1.4	NA	1.4	NA	NA	NA	3 Days/Week	8-HC
Total Residual Chlorine (ug/l) [b] [c]	88	NA	130	NA	NA	NA	1/Day	Grab
Dissolved Oxygen	NA		NA		6.0	NA	1/Day	Grab
pH (standard units)	NA		NA		6.0	9.0	1/Day	Grab
Total Phosphorus [e]	NL	NL	NA	NA	NA	NA	2/Month	8 HC
Total Phosphorus (kg/month) [f]	NA	NA	NA	NA	NA	NL	1/Month	Calculated
Total Phosphorus (kg/calendar year)[f]	NA	NA	NA	NA	NA	10,000	1/Month	Calculated
Orthophosphate [e]	NL	NL	NA	NA	NA	NA	2/Month	8 HC
Total Kjeldahl Nitrogen (as N) [e]	NL	NL	NA	NA	NA	NA	2/Month	8 HC
Nitrate plus Nitrite (as N) [e]	NL	NL	NA	NA	NA	NA	2/Month	8 HC
Total Nitrogen [d, e]	NL	NL	NA	NA	NA	NA	2/Month	Calculated
Total Nitrogen (kg/month) [f]	NA	NA	NA	NA	NA	NL	1/Month	Calculated
Total Nitrogen (kg/calendar year)[f]	NA	NA	NA	NA	NA	100,000	1/Month	Calculated

* = unless otherwise noted NL = No limitation, monitoring required. NA = Not applicable
TIRE = Totalizing, indicating and recording equipment

[a] The design flow of this treatment facility is MGD. See Part I. for additional flow requirements. **(REFERENCE THE 95% FLOW CONDITION)**

[b] See Part I.B for additional chlorine monitoring instructions.

[c] See Parts I. .a. and I. .b. for quantification levels and reporting requirements, respectively.

[d] Total Nitrogen, which is the sum of Total Kjeldahl Nitrogen and Nitrates plus Nitrites, shall be derived from the results of those tests.

[e] 2/Month = two samples taken during the calendar month, no less than two weeks apart.

[f] See Part I. for nutrient reporting requirements

[g] There shall be no discharge of floating solids or visible foam in other than trace amounts.